YARD OPERATION

FOURTEENTH PAPER

PARAGRAPHS 911 to 957

STOCK KEEPING
CHARACTERISTICS OF WOOD
GRADING

WESTERN RETAIL LUMBERMEN'S ASSOCIATION

Training Course.

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by
N. G. NEILL.

Winnipeg, Canada -:- August, 1919

W.R.L.A. TRAINING COURSE

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YARD OPERATION.

WINNIPEG, CANADA - AUGUST, 1919

YARD OPERATION

911. It is deemed advisable to make these papers as concise as possible, and yet emphasize outstanding features. We introduce, therefore, as a record, a standard stock based on an average yard.

	300	200	600	600	800	200	200	Feet
2x4	8	10	12	14	16	18	20	26,934
	200	100	200	200	300	100	100	
2x6	8	10	12	14	16	18	20	16,400
	100	100	100	75	50			
2x8	12	14	16	18	20			8,733
	100	100	150	50	50	25		
2x10	12	14	16	18	20	24		12,500
	50	50	50	25	25			
2x12	12	14	16	18	20			6,100
	50	50						
3x12	16	18						5,100
	25	25	25	15	15			
4x4	12	14	16	18	20			2,160
	25	25	25	20	20	15		
4x6	12	14	16	18	20	24		4,340
	15	15	25	15	15	10		
6x6	12	14	16	18	20	24		4,800
	50	50	50					
2x2	12	14	16					700

1,200	Lin. Ft. 1x2 Com. S1S	200
20 M	Ft. A.W. Com. Boards S1S No. 2 Coast or Mtn. or No. 3 Spruce	20,000
2 M	Ft. 4 in. Stock Boards S1S	2,000
3 M	Ft. 6 in. " "	3,000
4 M	Ft. 8 in. " "	4,000
5 M	Ft. 10 in. " "	5,000
5 M	Ft. 12 in. " "	5,000
7 M	Ft. 10 in. Resawn	7,000
30 M	Ft. 8 in. and 10 in. Shiplap	30,000
6 M	Ft. ½x6 Bevel Siding	6,000
6 M	Ft. 1x6 1st Grade Drop Siding	6,000
10 M	Ft. 1x6 Barn Grade Drop Siding	10,000
4 M	Ft. ⅝x4 V Jt. Ceiling	4,000
4 M	Ft. 1x4 V Jt. Ceiling	4,000
5 M	Ft. 1x4 Flooring 1st Grade	5,000
8 M	Ft. 1x4 Flooring 2nd Grade	8,000
8 M	Ft. 1x6 Flooring No. 3 Mountain, No. 2 Northern and No. 3½ Coast	
6 M	Ft. 1½x6 Bevel Well Cribbing	6,000

5 M Ft.		5,000
	4 in. Shelving S4S 12, 14 and 16.	
	6 in. " "	
	8 in. " "	
	5 in. " "	
	10 in. " "	
	12 in. " "	
5 M Ft.		5,000
	4 in. Finish S4S 12, 14 and 16	
	6 in. " "	
	8 in. " "	
	5 in. " "	
	10 in. " "	
	12 in. " "	
200 M Shingles.		
1 Car Posts.		
20 M Lath.		
250 Lin. Ft. 1¼ Stepping.		
250 " " 1½ "		
2 M " " Casing.		
1 " " " Base.		
3 " " " Quarter Round.		
2 " " " Cove.		
1 " " " Lattice.		
1 " " " Parting Stop.		
500 " " Cap Trim		
500 " " Neck Mould.		
500 Ea. " " Crown Mould 1½ and 2½.		
500 " " Baluster Stock.		
500 Ea. " " Bed Mould 1½ and 2½.		
500 " " Drip Cap.		
1 M " " Door Stop.		
250 " " Hand Rail.		
2 M " " Window Stop.		
1 " " " Picture Mould.		
24 K.D. Window Frames.		
24 " Door Frames.		
12 Windows 8x10—8 lt.		
6 " 10x12—8 lt.		
12 " 12x20—4 lt.		
24 " 12x24—4 lt.		
6 " 20x20—2 lt.		
24 " 24x24—2 lt.		
12 " 24x26—2 lt.		
24 Sash 8x10—3 lt.		
24 " 8x10—4 lt.		
12 Doors 2-0x6-0—1⅜.		
6 " 2-4x6-4—1⅜.		
24 " 2-6x6-6—1⅜.		
12 " 2-8x6-8—1⅜.		
6 " 2-10x6-10—1¾.		
*6 Front Doors (Glass) 2-8x6-8—1⅜.		
*6 " " " 2-10x6-10—1¾. Assorted.		
50 Base Blocks.		
50 Base Corners.		
50 Rolls Tar Paper.		
25 " Plain Paper.		
15 " Sheathing.		
10 " Roofing.		

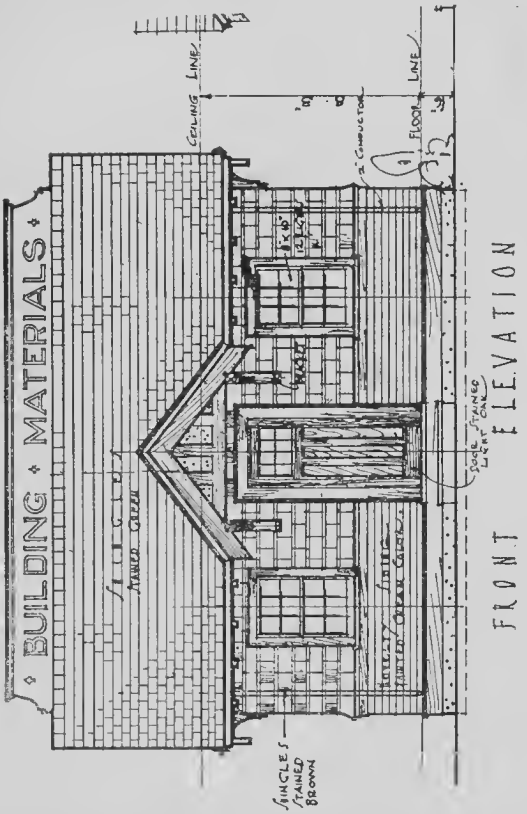
* One or two common glazed doors should be carried, but fancy front doors should be selected from the many catalogs available. Thus they do not become dust stained.

OFFICE

912. The office should be large enough to accommodate at least seven people at a time. There should be space provided, in addition to a general office, for a private room where you can deal in a confidential, private way with your customers. The general office especially should contain pictures and blue prints suggesting building, and have nothing in the office but pictures and things which will suggest building. There should be space for displaying new types of doors and windows. Remember the general office is your sales room, preferably there should be a large window in the general office looking out on to the main thoroughfare. Use this window to display your goods.

913. "It pays to keep your office tidy". Provide enough chairs for your customers. It is a good idea to have a table in the middle of the general office on which there will be found books dealing with the subject of building.

914. An attractive office recently built in Alberta is here shown. The point is emphasized that the office building itself should be built in a manner to suggest a modern and attractive building.



The floor plan of this office shows an overall measurement of 20x14, a general office measuring 11 ft. 6 in. x 12 ft. 6 in., and a private office 7 ft. 3 in. x 12 ft. 6 in.

OFFICE RECORDS

915. Have your office equipped with proper filing systems so that you can put your finger on any paper you want at a minute's notice. Have all your record books properly written up from day to day, and every transaction put into writing. When you order stock have a duplicate copy of the order on file, the price distinctly shown, and attach to that order the acceptance by the party from whom you are buying. If the seller should not be a mill, then get an acceptance of the order from the mill, never leave anything open for dispute. It is often the neglect of what appears to be a very simple thing at the moment, which later on is the cause of disputes and loss of money. Do not wait for the seller to send you an acceptance, see that you get it within a reasonable time.

916. Should a seller wire you in connection with an order, if a reply is called for, send the reply by wire. Especially where the wire involves a monetary consideration, remember that the only party responsible for any error is yourself, therefore confirm all wires, by mailing an exact copy of the wire the same day, and get an acceptance of that wire, clearly setting forth the exact wording, terms or figures which you placed in the communication. Remember nobody will take care of you, or is in any way responsible for your actions but yourself. Protect your own interests.

ARRANGEMENT OF YARD

917. The yard should be arranged primarily for convenience in loading. The driveways or alleys should not be less than 22 ft. Theso driveways must be slightly higher than the bottom of the piles, and hard and even surfaces free from loose material, with plenty of room at turns.

918. The whole yard should be drained by ditching or sub-soil pipe. Any low spots in the ground should be filled up. A yard was recently seen where, in the spring of the year, some bundles of shingles were actually under water. This kind of thing not only gives a bad impression to your customers, but damages the stock, and thereby you are going to lose money, as well as lowering the general standard of your business.

Right here let us say that your yard will always reflect your personal ideas and manner of life, through it, and you unintentionally convey your own attitude and thoughts to your customers thereby.

919. As a rule a yard stock should be arranged in the following order, conforming to the usual method of making up a load:

Dimensions.
Boards.
Shiplap.
Drop Siding.
Flooring.
Finish.
Moulding.
Windows.
Doors.
Paper.
Roofing, etc.
Shingles.
Lath.

Be able to drive down one alley and up the next, and pick up the load in this rotation. Where the yard is not at present in first-class shape, a definite policy should be laid down to gradually bring it into shape, possibly by changing the place of piling new stock, etc.

Stock most called for should always be nearest the office.

Always have the yard gate and fence in thorough repair.

920. The warehouse must be given special attention, as the stock, being out of sight, is liable to be left untidy, and will consequently take more of your time when filling a customer's order.

Do not have the warehouse crowded, it is your supplementary sales room. You want to have room to display the goods as well as store windows, doors, etc.

921. You must always bear in mind the fact that some day you might not be there to look after the yard. One very excellent yard which was visited recently took care of this feature by having little brass holders under each bin in the shed which contained cards telling exactly what the bin contained and also showed the price in code, so that a comparative stranger could walk round that yard and fill an order as well as the owner.

SHEDS

922. A great deal has been written on the building of sheds. This will depend mainly upon your requirements as to whether you build a single or double shed, although a double shed is more economical in the end, and gives better protection for the stock, being completely roofed over.

The shed must be on a very firm foundation, and should be built preferably of 3x6. It should have doors on each end, and an overhead bridge for every 50 ft. of shed. Galleries must be substantial, usually 4 ft. wide with smooth finish hand rail. Have a toe board nailed along outside edge of platform to prevent slipping off. A ladder with V-shaped blocks at top, so as to fit on to gallery floor is convenient. Gaps may be left in hand rail every ten feet for access from ladder. A straight stair takes up room, and necessitates extra work.

One ideal plant which was seen recently had electric light in the shed. Considerable loading will be done in the darkening hours in the winter, and should it not be possible to instal electric light, if you are building a long shed, the centre of which may be dark, it is advisable to have gable windows worked into the roof. These windows should face west so that you will get all the light possible up to the last minute of sunset.

923. All finished lumber, moulding, etc., should be stored in a shed. Bins should be 22 ft. deep, of such width that stock can be piled within a few inches of each side. Avoid having even feet between posts. A bin measuring 9 ft. on centre is very satisfactory. This provides for storage of 24 ft. piles of same material on each side—so that new stock does not need to be piled on old. A piling board for use in placing lumber in bins is good. All bins should be standard length. A shaped grip can be secured on each post to hold piling board as it is moved up, or the board fitted with two clamps, which are secured to posts and elevated as pile rises.

924. Alleys can be provided between rear of bins and walls where extra long pieces can be stored parallel with shed, or where everything is kept in a shed, wide doors hinged at top can be arranged in walls so that heavy timbers can be stored at back of bins. This requires driveway down each side of shed.

925. Moulding should be either stood on end or piled in racks, when there should be practically a continuous bearing, otherwise they are liable to bend and warp.—The shed must be kept dry.

Lumber not thoroughly dry should not be put in the shed until it is dried in the open air.

DARK STORAGE

926. Cement, Lime and Plaster must be stored by themselves, or in one shed properly divided off. This storage shed should have double floors and walls with not less than 2 in. air spaces. There should be no windows, the door should be kept tight and just as much a non-conductor of the atmosphere as the walls and floor, therefore build double with air spaces. This building should be raised off the ground at least 6 in. with openings for the circulation of air underneath.

Construction of the sash and door warehouse should be very much the same.

MAINTENANCE OF STOCK

927. This requires first a system to be established, and second, the continued, prompt carrying on of that system. Make it your first duty in the morning after opening the gates to go through the yard and note all low stocks, and at the same time straighten out the piles and clear up the yard generally.

Your ordering must be based on, first, the length of time it ordinarily takes, at that specific time of year, to get delivery; second, the class of building which is developing in your district. You know the type of building you are exploiting, and that should be the building that is being built. Third, you must keep an eye on general conditions; and fourth, the quantity of each particular line of stock on hand in the same period during the previous year.

Always take the initiative in ordering your stock. Never wait until a traveller calls on you, he may then sell you what he wants to sell, and not what you actually require. Unless this matter is properly handled, you are liable to get overloaded in certain lines and be short in others.

Always keep well stocked up on staple lines such as Dimensions, Shiplap, Boards, etc., and material which has to come from a distance. When it comes to windows and doors and millwork generally, keep these down to the minimum.

927A. The following valuable and interesting tables were compiled from yard records of the average country yards. A close study of each of these tables must prove a valuable guide to buying and stock keeping.

AVERAGE PERCENTAGE OF EACH KIND OF STOCK HANDLED, TAKEN FROM TEN YARDS, AVERAGE THREE YEARS EACH, OR ONE YARD FOR THIRTY YEARS.

TABLE I.

2x4	12	
2x6	8	
2x8	3½	
2x10	3½	
2x12	4	69%
4x4 to 8x8	3	
Boards	13	
Shiplap	22	
Dropsiding	8	
Flooring	5½	
Lapsiding	3	
Ceiling	2½	
Finish	3½	
Well Curbing		
Hardwood		
1x2		
2x2		
Resawn	8½	
Base		
Casing		
Jamb		
Stepping		
	100%	

AVERAGE PERCENTAGE OF SALES ANNUALLY.

TABLE II.

Lumber	67.93
Shingles	5.77
Lath	.77
Moulding	1.19
Sash and Windows	2.66
Doors	1.42
Millwork	.14
Fenee Posts	4.47
Roofing and Paper	2.39
Frames	.68
Lime	.63
Cement and Plaster	4.92
Brick	1.00
Empty Sacks	.17
Jamb, Casing and Base	.72
Wall Board	1.50
Screens, Doors and Windows	.30
Aerators	.24
Wagon Tongues and Bottoms	.16
Can't Sag Gates	
Hair	
Coal	2.53
Miscellaneous	.41
	100%

TIMES STOCK IS TURNED OVER ANNUALLY.

TABLE III.

Lumber	1.73
Shingles	1.99
Lath	1.36
Mouldings	.80
Sash and Windows	1.46
Doors	1.34
Millwork	.58
Fence Posts	3.34
Roofing and Paper	1.52
Frames	1.02
Lime	7.00
Cement and Plaster	3.96

Brick	1.54
Empty Sacks	.53
Jamb—Casing and Base	1.00
Wall Board	3.26
Screens—Doors and Windows	1.26
Aerators	.85
Wagon Tongues and Bottoms	.37
Can't Sag Gates	1.82
Hair	.65
Coal	6.90
Miscellaneous	1.00

NEW STOCK AND OLD

928. Never pile new stock on top of old, otherwise your old stock will continue to get still older, and gradually become unsaleable. Narrow piles will help in this connection. You may have to cut strips specially for interlaying. Have your piles sloping evenly outwards over the alley. To do this start each layer with an inch projection over the previous layer in the front line.

PILING BUNDLES

929. To pile tied bundles evenly, lay a 1x12, smooth side up, on one side of pile, bring each bundle even by butting ends on a plank on the ground. Then slide bundle back along the 1x12, and roll bundle off when opposite location desired on pile. Then shift over the 1 x 12 sufficient to allow next bundle to drop from the 1x12 into its exact spot. Thus the difficulty of the cords on one bundle enterfering or catching the cords on the lower bundle is overcome, and your bundle pile presents a tidy appearance.

930. Piles may be carried 17 ft. in height. This seems to be about the limit for economic and efficient handling. There should be a board projecting on the back every 12 inches, offset so as to form a stairway to get up to the top of the pile. All piles must have sufficient space all round to provide free circulation of air, and there should be three pieces crossways, one in front, one in centre and one at rear, between each layer of lumber, so as to give a grip for the lumber when loading it, and also let the air circulate. The cross pieces should be placed exactly on top of the ones beneath to make pile uniform.

KEEP REAR OF PILES CLEAR

931. A yard was recently seen where one row of piles backed up to a lot of bushes on the next lot. The foliage on these bushes was so heavy that it created an absolutely damp and non-air circulating space at the back. This was not apparent at first glance through the yard, but on investigation it was found that the ends of all the boards backed up to these bushes were being spoiled by mildew and dampness.

In the same yard weeds were allowed to grow between the piles. This not only looked like poor management, but was wasteful, as it was actually injuring the lumber. Watch these points, it will pay you. Get out and look around your own yard when you are reading this, and see what you can do to improve it.

PILING BASES

932. Must be built very firm and have sure foundations. There should be three foundations, one at the front, one at the centre and one at the rear, running the whole length of each piling space, placed wide enough apart to just carry the shortest length, or what is better for a

really good yard, have a permanent place for the long stuff, and then the rear piling base could be varied to suit. The front and centre piling bases could be all in the same line.

Concrete foundations and bases are good, but must have lots of openings to provide free circulation of air underneath. Heavy wooden posts, say 6x6, can be sunk into the ground every 6 ft., and a wooden piling base built up on the top of that, but unless the ground is exceptionally firm there should be a concrete pedestal at least 12x12 placed at the bottom of the posts, or else pieces of wood 12x12, 3 in. thick, used as a base. Where wood is used for this work, however, it should be treated with creosote or heavily tarred before being put into the ground. Foundations must vary in height from front to rear so as to provide for a drop of 1 in. in the foot, assuring the proper shedding of rain.

ROOFING PILES

933. Where lumber is stored as a reserve, or during quiet periods, piles should be roofed by placing six cross pieces, one on top of the other in front, and two or three at the rear, depending on the length of the pile, then there should be laid at least two layers of boards offset so as to cover all cracks.

Lumber S1S should be piled finished face downwards.

ECONOMY IN PILING SPACE

934. An economic method of arranging piles so as to use up every bit of ground to the best advantage, is to place a 22 ft. pile (in depth) backing up to say a 12 ft. pile in the next alley. This requires some careful systematizing of the yard, but it will repay the time and thought entailed.

PILING PIVOT

935. This is a very handy device, and a labor saver, constructed with an upright 4x4 with a steel pin sunk in the head, making a total height over pin of about 5 ft., secured to a substantial cross piece with necessary stays on each piece to the upright. This piling pivot can be easily moved around the yard and will be found very useful in piling lumber, and where lumber is loaded from the ground onto wagons, assisting in that operation.

TIMBERS

936. May be piled piece on piece lengthwise with alleys, preferably using one side of the yard for this storage. All timbers should be separated by small cross pieces which will help to keep them dry, and also make it easier to get a grip for handling. A well arranged, neatly and systematically piled yard is an asset. Nobody wants to do business in a dirty, untidy store, and the same comment applies to the Retail Lumber Yard even more strongly, because slovenliness in the yard, irregular piling and lack of system, shows up even more prominently than a similar condition in a store. Make your yard attractive, also let it be an inspiration to the district.

937. COMPARATIVE STRENGTH VALUES FOR STRUCTURAL TIMBERS

AVERAGE STRENGTH VALUES FOR STRUCTURAL TIMBERS.

Established by the U. S. Government.

SPECIES	Green Stringers		Air-Seasoned Stringers	
	Breaking Strength		Breaking Strength	
	Lbs. per sq. in.	Percent	Lbs. per sq. in.	Percent
Douglas Fir	6605	100.0	7142	100.0
Longleaf Pine	6437	97.4	5957	83.6
Shortleaf Pine	5948	90.0	7033	98.5
Western Hemlock	5821	88.1	7109	99.6
Loblolly Pine	5568	84.4	6259	87.7
Western Larch	5562	84.2	6534	91.5
Redwood	5327	80.6	4573	64.1
Tamarack	4984	75.5	5865	82.3
Norway Pine	3767	57.0	5255	73.7

DISPOSITION OF OFF GRADES

938. There should be a special place in your yard and shed for off grades and shorts. Do not mix these with your regular stock, it gives a bad impression to the customer to have you throw out a board when loading his rig, and encourages the buyer to become critical, and take the initiative in throwing out pieces.

Make a feature of selling the off grades and shorts, or defective stock. Do not let it stay in your yard any longer than possible, make a bargain price and get rid of it. By questioning a customer as to what he wants to use his material for, you will very often find that this class of stock will fill the bill, he will be glad to take advantage of it, and you will keep your stock cleaned up.

Make use of this class of material in making your own repairs around the yard. Again, it may be used for manufacturing commodities which your customer may want, such as hay racks, portable chicken houses, etc.

DISPUTED STOCKS

939. One of two things may be done with orders which you believe are not up to standard of the goods ordered, either left in the car, and the seller immediately notified by wire, or else taken out of the car and piled separately. In such a case, however, pile it wide and low so that it may be more easily inspected. Do not sell or touch disputed stocks until adjustment is finally made.

WHY 16 FT. LENGTHS SHOULD BE AVOIDED

940. It would be a difficult matter at this time to place the responsibility, but, it is a fact that among the multitude of lumber users in this country there has been, and is now, the idea that all timber grows 16 ft. in length, and probably this has caused the belief that all buildings can be erected most advantageously using 16 ft. dimensions wherever possible.

In the old days when Eastern Canada and the Northern White Pine area in the United States were the lumbering centres of this continent, it is true that the tree lengths were such that 16 ft. logs could be cut as easily as any other length, and, possibly to better advantage, but in those days the loggers and lumbering firms paid little attention to the wastage in logging, and, our present day loggers are faced with a different problem, that of using the entire log from the ground up.

Then, too, the lumbering centres of the continent have changed, and we now find them moved to the West, and the centres are now located in the Mountain groups of mills, and those located on the B.C. Coast. In the United States this also holds with the mills of the Inland Empire and those of the Pacific Coast. It is true that even now among the mills in the mountains and the Inland Empire it is still possible to cut 16 ft. lengths to advantage, but we find that the largest quantity of common timber is now cut and shipped by the mills of the Coast groups.

The following table was compiled from figures taken from ten booms of fir logs, coming into Vancouver from a number of logging operators from Howe Sound to Campbell River, B.C. It will be noted that these booms ran from 12 ft. to 48 ft. in length, but there are only two lengths which will cut 16 ft. dimensions or commons to advantage, 16 ft. and 32 ft., and these two lengths represent only 25 per cent. of all the lengths contained in the ten booms.

DIFFERENT LENGTH OF LOGS UP TO 40 FEET, TAKEN FROM 10 FIR BOOMS

		Percentage			
5	Logs	.16	12	Feet	Long
1	"	.03	14	"	"
12	"	.40	16	"	"
21	"	.70	18	"	"
63	"	2.11	20	"	"
85	"	2.85	22	"	"
471	"	15.81	24	"	"
115	"	3.86	26	"	"
246	"	8.25	28	"	"
240	"	8.05	30	"	"
720	"	24.01	32	"	"
134	"	4.49	34	"	"
271	"	9.09	36	"	"
91	"	3.05	38	"	"
504	"	16.91	40	"	"
2,979					

The orders which generally receive first consideration from the manufacturers are those from the railway companies. These are always desirable orders, for the reason that the timber orders involve little machining, and the other products, such as car siding, flooring, etc., are generally ordered in large quantities, thus making desirable cutting orders for the mills, as such orders do not have to be piled up in the yards but are shipped out at once. The timbers for bridge-strings, snow-sheds, etc., are nearly always required in 30 and 32 ft. lengths. Figures are not available on these shipments, but the quantity would cut down materially the percentage of 32 and 16 ft. lengths remaining, for the rail or prairie trade.

Further than this, the car siding for steel frame box cars, most generally built now, is all cut 16 ft. long or multiples thereof (2x6, 16 No. 3, and better, being required for the sides, and 8 ft. for the ends). Then, the V Joint used for the car doors is also used in the 8 ft. lengths. When all these requirements are taken from the booms it will bo readily seen that the percentago of 16 and 32 ft. logs has been greatly reduced. This proportion has become so widely varied that the coast manufacturers have placed a premium of $1.00 a thousand on all 16 ft. lengths of dimensions, and many retailers have asked why this was necessary. The following table, showing retail sales of common lumber in the three prairie provinces, will prove of interest, and shows that the $1.00 premium was intended to curtail the sales of 16 ft. lengths and balance up the proportion of other lengths used.

Table showing percentage of lengths of dimension in sales of one yard picked at random from a system of 76 yards. This is a typical Saskatchewan yard selling Coast dimension exclusively. The figures represent sales for the four months of August, September, October and November, 1917.

	8 Ft.	10 Ft.	12 Ft.	14 Ft.	16 Ft.	18 Ft.	20 Ft.
2x4	3.69	10.54	17.10	20.45	39.61	7.03	1.55
2x6	.10	9.30	26.71	12.64	34.48	11.48	4.70
2x8	—	.10	16.34	19.18	44.51	10.48	9.32
2x10	—	9.95	9.55	12.53	61.66	5.81	.50
2x12	.11	—	22.11	12.03	54.42	3.32	7.94

It will be readily seen that 16 ft. is far in excess of any other length, and, comparing the sales figures with the length of logs coming to the mills it will also be seen that the logs which are intended to be cut up for 16 ft. lengths will not hold up to the percentage which the prairie trade demands. This makes it necessary for the mills to cut other lengths than 16 and 32's, entailing a wastage which must be covered by the extra charge of $1.00 per thousand.

The 40 ft. logs represent a good percentage in each boom, and these can be used to cut 16 ft. lengths, but leave an 8 ft. remaining. A glance at the tables of sales show that this length is very little bought or sold by the yards, and this is an item that calls for some remarks.

How often does the following occurrence take place? A customer asks for 25 pieces of studding for spring repairs. The lumber dealer asks, "What length?" and, nine times out of ten the answer is, "Oh, 16 ft., I guess." Now the average customer will not use a 16 ft. piece of 2x4 without bracing in the centre, and very frequently before the pieces are used they are cut into 8 and often into 4 lengths. A little judicious questioning and salesmanship on the part of the dealer would have shown for what purpose this was to be used, and sale resulted for 4, 6, or 8 ft. dimensions, and these lengths would have filled the requirements as well as 16's.

The average country contractor in making up a bill of material will figure so many partitions and wall studs, which in many cases are for 8 ft. walls. Yet, when making up this specification he will show one 16, for two 8 ft. pieces. Consideration of this problem here would save money.

Common uses for 2x4's around a farm outside an actual house or barn building are gates, hog pens, hay racks, calf pens, fence braces, and chicken runs. For practically all of these 4, 6 or 8 ft. pieces are used, yet the sales tables shown, clearly indicate that the dealer does not sell these lengths but the longer ones, which are later cut up.

There are two distinct and favorable reasons for the increased uses of 4, 6 and 8 ft. lengths. First, the mills always have a surplus of these, and they can be bought at prices considerably lower than the standard lengths. Secondly, that the grade of the short lengths is almost always better than the long ones. There are fewer knots, and often the mills in trimming up dimensions will cut 4, 6 or 8 from a longer piece to avoid a knot, thus leaving a clear short length. One objection which dealers offer against short lengths is that they cannot be so conveniently loaded or hauled on the ordinary waggon gear. This can be overcome by a little studying as to methods of loading. It is certain that the short lengths could be thrown loose into a waggon box, or on a hay rack and hauled perhaps easier than the longer ones.

Cut down your use of 16 ft. lengths.

THE STRUCTURE OF WOOD

941. For a starting point, let us consider what wood is and how it is put together; in other words, its structure. All of our timber trees grow by the addition of woody layers on their outside surfaces; when the growth is rapid, as in the spring, the wood formed is light and usually weaker than that produced later in the season when the growth is slower. Consequently, when we examine a cross-section of a piece of wood we find alternate rings of light and dense wood corresponding to periods of fast and slow growth. In climates such as ours these alternations come annually, so that by counting the number of "rings" we can tell the age of the tree, and by observing the frequency of these rings—the number of rings per inch—we can get an idea of how fast the tree grew. By the proportion of dense summerwood to light springwood, we get an idea as to the strength of the piece, since a stick showing a large proportion of dense wood will naturally be stronger than a stick of the same species with a smaller proportion of summerwood. It may be pointed out here, merely as a point of interest, that the rings merely indicate more or less abrupt changes in the rate of growth, and a tree may develop more than one ring in a season on account of some accidental cause, such as a period of heavy frost occurring after the tree has produced its buds in the spring. On the other hand, trees grown in tropical countries where the rate of growth is almost continuous the year round, may show no annual rings at all. Mahogany is an example of this.

In the growing tree it is only the outer portion of the trunk which takes part in the growth. This part is known as the sapwood on account of it being the part through which the sap and life juices of the tree are transported to and from the leaves and roots. The sapwood may be of any thickness up to about four or five inches. Inside the sapwood is the heartwood, which takes no active part in the life of the tree other than to furnish strength and stability. It is usually somewhat darker in colour than the sapwood. In the growing tree,

the heartwood is more liable to decay than the sapwood, while in timber the reverse is the case. In the standing tree the resistance to decay possessed by the sapwood is due to the protective action of living tissue in much the same way that the tissues of living animals are protected. But why this condition should be reversed when the tree is cut is not entirely understood.

The wood itself is made up of minute fibres running in a vertical direction in the trunk. By examination under the microscope these fibres are seen to be of several different varieties and to have different kinds of work to do in the life of the tree. However, in the woods with which we have most to do, the great bulk of them are very much the same and we will not undertake to examine them very minutely. These fibres are little, short, more or less pointed tubes having walls which are more or less thick, according to whether they were produced during growth late or early in the season. It is this thickening of the walls that makes the difference between the summerwood and the springwood in most of the common trees. There are some other differences, especially in hardwood, but since softwoods are the most important to us we will only consider these. The length of these fibres may be anywhere from 1/20 to 1/4 of an inch, their diameter is about 1/100 of their length. The fibres running vertically are crossed at intervals, by other bundles of fibres more or less similar, running horizontally in a radial direction in the tree. These later bundles are called "medullary rays" or simply "rays". They pass from the pith to the bark, their purpose being to bind the whole structure together and conduct moisture from the sapwood to the centre of the trunk. In the soft woods they are usually in very small bundles though still sufficiently prominent in a cross section, to be visible to the unaided eye. They appear as very fine lines running at right angles to the annual rings. In some of the hardwoods, particularly oak, the rays are very prominent, the bundles often being an eighth of an inch thick and an inch or more deep. When oak is quarter cut, the flat sides of these bundles are exposed and form the distinguishing silver grain. But even in oak the great majority of the rays are small in size and will only be noticed on close inspection.

It must not be understood from the above, that these are the only elements that go to make up wood structure, but only that in the common soft woods these are the more important parts. Hardwoods have a great variety of cells, the most prominent of which are the kind known as vessels; these are long hollow tubes made of short cylinders placed end to end and which may run the whole length of the stick. You will see them most easily in a wood like ash or hickory. These vessels are the real distinguishing feature between hardwoods and softwoods. The actual hardness of the wood has little to do with it, since some "soft" woods are harder than some "hardwoods". Douglas fir, for instance, is harder than poplar.

SEASONING OF WOOD

942. But to come back to our fibres. The material of which they are composed is a very complex chemical compound related to starch and cotton. It is very resistant towards most chemicals, though when treated in certain ways it will partly dissolve, leaving a still more re-

sistant substance which has almost identical properties with cotton and which, as "sulphite pulp" forms the basis of a very large amount of paper. The cell material "ligno-cellulose" has one very important property—it swells up when it is wet and contracts as it dries and from this comes all the troubles of seasoning wood.

In a stick freshly cut or which has lain in water since being cut, there is a large amount of water amounting to anywhere between 30% and 130% of the weight of the dry part of the wood. This water is there in two forms. Part of it is soaked up into the cell walls and the rest of it fills up the spaces inside the cells, which you remember are short tubes. The water that is in the cell cavities has no effect on the swelling, it is simply "present". But the water that is absorbed into the cell walls is responsible for all the expansion of those walls.

Now consider what happens when we dry the stick slowly. First the water in the cell cavities evaporates and the stick gradually gets lighter and lighter owing to the loss of this water. It loses a great deal of water before any shrinkage occurs, but after the moisture is reduced to a certain point, shrinkage sets in and continues with loss of moisture until the stick is absolutely dry. What happens is this,—during the first part of the drying, the cell walls remain saturated with water and so are swelled up as far as they can be. The water lost is all free water from the cell cavities. But when this latter is all gone and the cell walls themselves start to dry up, they start to shrink. The amount of moisture needed to saturate the cell walls is about 30% of the oven dry weight of the wood or in other words the "fibre saturation point" is about 30%.

Now let us consider what effect the structure has on the shrinkage. In the first place, we must remember that this shrinkage is almost entirely in the diameter of the cell and not in its length. Most of our cells run lengthwise of the tree so that we will not expect much shrinkage in length, and if they all ran in this direction things would be very simple, because the shrinkage in diameter would be proportional to the shrinkage in circumference. Unfortunately we have the ray cells to consider. These lie with their long axis in the direction of the diameter, so that they will oppose shrinkage in this direction—usually known as "radial" shrinkage. The ray cells can shrink in a direction tending to shorten the circumference or the "tangential" direction, so that here the shrinkage of both sets of cells is in the same direction, and consequently the tangential shrinkage will be greater than the radial, also, both will be much greater than the longitudinal. Practice agrees with theory in both these conclusions. Radial shrinkage is about one half the tangential shrinkage, and longitudinal shrinkage is so small as to be almost negligible. The actual total amount of this shrinkage varies in different woods, and is to some extent, proportional to the density of the wood; in coniferous woods or "softwoods" radial shrinkage ranges from 2 per cent. to 6 per cent., tangential shrinkage from 5 per cent. to 8 per cent., while the shrinkage in volume is from 7 per cent. to 13 per cent.—all figures referring to the shrinkage from green to oven dry conditions.

With these facts in mind we can understand better some of the things that occur in drying wood. Suppose we start with a green log. As it dries the outer layers

shrink much more than the radial shrinkage allows for and something must give. Usually a check develops and so the strain is relieved; but if the drying takes place slowly at a high enough temperature, the cell walls are sufficiently plastic so that their shape can alter and the difference be made up in this way without checking. To accomplish this on a very large stick, requires careful and scientific drying such as is very difficult to obtain in practice, and in consequence, large pieces usually show season checks on the ends.

Suppose we take a board. Usually it is one cut at some point intermediate between the centre of the tree and the bark. Since one side of it is more nearly in a tangential direction than the other, that side in drying will shrink more and the board will warp, the tangential side becoming concave.

Suppose we dry a stick rapidly—as in a dry kiln—the outer layers will dry first, and if the drying is very rapid, the outer layers may become almost completely dry before the inside commences to dry at all. The outside does not get a chance to shrink on the inner layers and it becomes hard and set in about the same size as when green, while the inside still contains moisture and so "case hardening" is produced. When the inside subsequently dries the shrinkage is away from the centre and may be so great as to cause checking or "honeycombing". The remedy is simple—don't dry so fast that the moisture is removed from the outside at a greater rate than it can travel through the wood. The whole art of running a successful dry kiln is to regulate the temperature and humidity of the air to which the wood is exposed, in such a way as to bring off the moisture as rapidly as possible without unduly straining the wood. The higher the temperature the faster the drying, and the more plastic the wood is; the higher the humidity the slower the drying, so that if the wood is heated in a very moist kiln for some time until it is at a uniform temperature throughout, and then the humidity of the kiln is lowered gradually so that the moisture is reduced evenly through the stick the best results will be obtained. The rate at which the humidity may be lowered will depend on the kind of wood being treated and the size of the pieces. The degrees of control which it is possible for the operator to exercise will depend on the design of the kiln.

Before leaving the question of drying there is one more thing to be mentioned. Wood in contact with ordinary air is never completely dry; it always contains an amount of water which is in some proportion to the relative humidity of the air with which it is in contact. If the humidity of the air increases, so does the moisture content, and the wood swells but shrinks again when the humidity decreases. An average moisture content for wood indoors is about 6% to 10% so that it is of no value to kiln dry lumber below this point, since it will pick up this much moisture from the air.

DECAY OF WOOD

943. There is another subject in which every one handling wood will be interested—that is the decay of wood. That wood will decay has been known ever since it was first used and records show that intelligent efforts to avoid decay were made thousands of years ago. Solomon, or his Temple architect, was aware of the value of free

circulation of air to reduce damp, and so "he made narrowed rests round about, that the beams should not be fastened in the walls of the house". The famous wooden statue of Diana of the Ephesians, was kept saturated with oil of Nard by means of a number of small orifices in the woodwork, in order to prevent decay.

The changes which take place in the structure of wood and constitute decay, are due to the activity of certain lower forms of plant life, bacteria and fungi, chiefly the latter. The term "decay of timber", is now understood to mean a breaking down of the complex compounds which it contains by means of ferments secreted by these organisms. These dissolve out and destroy certain parts of the cell walls, and so break down the entire structure of the wood. In most cases, there is little or no evidence of the presence of fungus on the surface until the disease has developed to a considerable extent. The fungus acts mostly through very fine filaments that work their way between and through the fibres of the wood and gradually destroy them. The fruiting bodies of the fungus are the toadstools that you find so often both on live and dead timber. Fungi are propagated by spores which are discharged in clouds from the under surface of the toadstool. Being very light and very numerous, these spores are carried about by the wind, and lodging in cracks in bark or wood, they germinate and so disease is spread. So easily do these spores travel that it may be stated with almost positive assurance, that every piece of board cut in the forest is infected with fungi.

Besides spreading by means of spores from the fruiting bodies the fungus can spread by means of the fine filiments. When conditions are favorable for the growth a very small bit of infected wood in contact with sound wood, will spread the disease, and in a very short time the whole is on the road to destruction. Even the saw of the workman may carry the disease from diseased to sound timber. And at times the filaments have been observed to reach across considerable distances of stone, etc., to get from one piece of timber to the next.

PREVENTION OF DECAY

944. Fortunately these fungi are not so hardy but that they may, in most cases, be either killed or conditions made so unfavorable for them, that their growth is very much restricted. The requirements of any kind of fungus are moisture, moderate temperature, air, and food. To control any one of these, is to control the growth of the fungus. Air dry wood does not contain enough moisture for any fungus to grow—not even Merulius Lachrymans, which is the one chiefly responsible for "dry rot" and which will live on less moisture than many others. But it must be remembered, that the fungus is inactive only while the wood is dry, and that if it is put into a damp place, the fungus, if present, will revive and go on with its destructive work. High temperatures will completely kill fungus and kiln dried lumber is pretty well disinfected by the operation. Very low temperatures retard the growth but seldom completely kill, while moderately warm temperatures are most favorable. Lack of air will prevent fungus from acting.—Piles placed centuries ago in positions permanently under water, or in heavy clay, have been found to be perfectly preserved. The fungus

also requires proper food for its existence. The cells of heartwood contain no living substance while the sapwood abounds with sugars, starches and protoplasm, all of which make excellent food for fungus, and consequently it makes much more rapid growth in sapwood than in heartwood. Many woods contain substances that are to some extent repellant to fungus. Cedar and cypress are examples. Possibly also, the resin in longleaf pine acts somewhat in the same way, though more likely, its action is due to its water-proofing qualities.

WOOD PRESERVATIVES

945. Antiseptics such as creosote, mercuric chloride, zinc chloride, sodium fluoride are effective in destroying fungus, and wood impregnated with these will give a much greater life than if untreated. The selection of a preservative depends largely on the particular conditions. Creosote, applied by a pressure treatment that gives good penetration, is probably the most satisfactory for many purposes but is rather expensive. The others are effective where there is not too much exposure to water, since they are all soluble salts and are liable to leach out after a greater or less period of time. Creosote applied by a brush, or open tank treatment, is cheap and sufficiently effective to more than pay for itself in most cases where extreme durability is not necessary. Several proprietary brands of preservative are on the market, but few of them show any advantage over plain creosote.

LUMBER YARD HYGIENE

946. Since the great bulk of lumber will be used without preservative treatment great care should be taken to prevent infection from rotten timber in the yards. Piles should be supported a foot or more from the ground, and should have a foundation of creosoted timber or of concrete. The ground around and under the piles should be kept clear of scraps of wood and bark, as these are nearly always infected, and if left lying around will spread the disease. Never put a partly rotten stick in a pile with good ones. Use good sound sticks for spacers; don't use rough edgings which should always be under suspicion. When a pile is taken down, have the ground cleaned up, and if you can, let the sun get at the space for a few days before rebuilding. In old yards a good, liberal layer of salt spread over the ground will greatly help get rid of lurking disease.

STRENGTH OF TIMBER

947. One of the most important qualities of structural timbers is strength, and a consideration of the factors affecting the strength will not be amiss. Aside from the comparison of different species, the characteristics to be considered are density of wood, direction of grain, moisture condition, proportion of sapwood and such defects as knots, checks and shakes.

The strength, hardness, shock resisting ability and stiffness of wood, vary with its weight in small, clear, straight grained pieces of the same moisture content. This applies to woods of different species as well as to different samples of the same kind of wood. Now, in any one sort of wood, a good comparison of the density may be obtained from the proportion of summerwood to springwood. As has already been noted, the summerwood

is much more dense than the springwood and is proportionally stronger. Consequently a stick which shows a large proportion of summerwood, is stronger than one of the same species which is largely springwood.

By direction of grain is meant the line formed by cutting the rings of annual growth. If a stick is sawed from a log in such a way, that these lines run diagonally across the stick instead of parellel to the edges, the load it will carry as a beam will be considerably reduced, and when failure does occur, it will be more sudden and complete. There is another kind of cross grain, known as spiral grain, which is much more difficult to detect than that just described. Ordinarily, the cells run lengthwise of the trunk, but occasionally a tree is found in which, due to some peculiar growth condition, the cells follow a spiral direction up the trunk instead of being strictly vertical. This will be noticed if the wood is split or if the direction of minute checks are observed in the seasoned wood.

The effect of moisture on strength is very marked in small clear specimens, but is not so evident in larger sizes on account of other defects which tend to counterbalance it. When wood is green, differences in moisture content are not noticeable, but when the moisture is reduced below the "fibre saturation point", which was mentioned before, the strength rises rapidly, so that a very dry stick may be from two to four times as strong as a green one. In very large timbers, drying usually causes checks and shakes which weaken the material, so that one effect balances the other, and it is not safe to assume any increase in strength due to seasoning. Seasoning is, however, very necessary if the timbers are to be put in a pooriy ventilated place since they are very prone to decay otherwise.

The proportion of sapwood has no relation to the strength of a stick, but it has a great bearing on its durability. Untreated sapwood is much more liable to decay than heartwood. On the other hand, when wood is creosoted or otherwise treated with a preservative by an impregnation process, sapwood is an advantage since the preservative penetrates it much more easily than the heartwood.

DEFECTS IN TIMBER

948. Knots and checks are common defects which influence strength. In beams the effect of knots is largely a matter of location. Knots near the centre of the lower face have much greater weakening effect than those near the ends. The next most vital part is the centre portion of the upper face. Knots which are close enough to the lower edge to turn the grain off, are much more important than larger ones which allow the grain to be continuous in passing. Loose or rotten knots are, of course, much more harmful than sound knots.

Checks are caused by stresses set up in seasoning, and are very difficult to avoid, especially in large timber. They are bad in proportion to the depth to which they extend along the stick. A shake is a separation between two annual rings; generally this occurs in only a part of a ring but may be complete. They are usually ascribed to the bending action of the wind, and though often not visable in green timber they show up on seasoning. Their

effects are similar to those of checks. Both checks and shakes are of more importance when occurring at or near the centre of the depth of a beam.

The influence of defects should always be considered in relation to the use for which the timber is intended. For instance, mudsills having numerous resinous knots would be alright but sapwood would be inadmissable. Beams in a dry place could have sapwood, but knots, especially on lower face, would greatly effect the strength.

Before giving a table of the strengths of various structural woods, it may be advisable to explain briefly some of the terms used.

ELASTIC LIMIT

949. When a load is applied to a beam, it deflects to a certain extent in proportion to the amount of the load. Up to a certain point, if the load is removed the beam will come back to its original position. But if the load passes this point, the material is permanently effected and does not completely recover. The limiting stress is known as the Elastic Limit. Fibre stress at Elastic Limit means, therefore, the extreme stress which the wood will stand without being permanently deformed.

MODULUS OF RUPTURE

950. It is the modulus of measure of the stress which will cause failure. The fact that there is a greater proportionate difference between this figure and that of the Elastic Limit in wood, than in other materials, indicates the ability of wood to be overloaded without giving way.

MODULUS OF ELASTICITY

951. Is a measure of the stiffness of the wood, and is a figure which must be used in calculating the amount which a beam will deflect under a certain load. Often a beam must be made much stronger than otherwise necessary so as to avoid undue deflection.

SHEAR

952. When the forces tend to cause one portion of the material to slide upon another adjacent to it, the action is called a shear. A tenon breaking out its mortise is a familiar example of shear along the grain, while the shoving off of the tenon itself would be shear across the grain.

Many investigators have made extensive series of tests of the strength of wood, but unfortunately it is not always possible to compare the results obtained, on account of the work having been done under different conditions. By far the best work along this line, is that which is being done by the U. S. Forest Products Laboratory at Madison, Wis. and the tests being made at the Forest Products Laboratories of Canada are carried on in such a way that when complete, they will be directly comparable with those of the United States, making it really possible to compare all the woods of America. The tests are made on small, clear straight grained specimens cut from trees selected as being of typical growth; all kinds of wood are tested under identical conditions, and a sufficient number of tests made to ensure a good average. The results are uniformly higher than tests made on large

sizes, since the small pieces are perfectly free from defects. Large timbers in green condition having no very harmful defects, give stresses about three quarters as great as small clear pieces cut from them.

It is usual for builders to use for calculation, a working stress obtained by dividing the breaking stress of a material by some factor called the "factor of safety". There is however, a tendency of late years to base calculations on the stress at Elastic Limit, rather than that of the breaking point.

The following tables show the average strength values of certain structural woods in green condition. The figures are taken from U. S. Forest Service Bull. 108.

AVERAGE STRENGTH VALUES FOR STRUCTURAL TIMBERS.

Taken from U. S. Forest Service Bulletin 108.

GREEN.

Table I.

SPECIES.	Cross Section Under Test, Inches.	No. of Tests.	Rings per Inch.	Fiber Stress at Elastic Limit, lbs. per sq. in.	Modulus of Rupture, lbs. per sq. in.	Modulus of Elasticity, 1000 lbs. per sq. in.	Relative Strength Based on Modulus of Rupture, Douglas Fir, 100%.	Relative Stiffness Based on Modulus of Elasticity, Douglas Fir, 100%.
Douglas Fir	8x16	134	10.9	4282	6605	1611	100.0	100.0
Long-leaf Pine	12x12 10x16 8x16 6x16 6x10	13	14.6	3855	6437	1466	97.4	91.0
Short-eaf Pine	8x16 8x14 8x12	33	12.3	3376	5948	1546	90.0	96.0
Western Hemlock	8x16	27	17.6	3761	5821	1489	88.1	92.4
Loblolly Pine	5x12 8x16	78	6.2	3266	5568	1467	84.4	91.1
Western Larch	8x16 8x12	43	23.9	3677	5562	1364	84.2	84.6
Redwood	8x16 6x12 7x9	30	19.5	4323	5327	1202	80.6	74.6
Tamarack	6x12	11	16.7	3231	4984	1268	75.5	78.7
Norway Pine	6x12	11	13.2	2397	3767	1042	57.0	64.7

AVERAGE STRENGTH VALUES FOR STRUCTURAL TIMBERS.

Taken from U. S. Forest Service Bulletin 108.

AIR-SEASONED.

Table II.

SPECIES.	Cross Section Under Test, Inches.	No. of Tests.	Rings per Inch.	Fiber Stress at Elastic Limit, lbs. per sq. in.	Modulus of Rupture, lbs. per sq. in.	Modulus of Elasticity, 1000 lbs. per sq. in.	Relative Strength Based on Modulus of Rupture, Douglas Fir, 100%.	Relative Stiffness Based on Modulus of Elasticity, Douglas Fir, 100%.
Douglas Fir	8x16	64	15.2	4931	7142	1641	100.0	100.0
Long-leaf Pine	8x16 6x16 6x10	7	12.7	3793	5957	1720	83.6	104.8
Short-leaf Pine	8x16 8x14 8x12	9	12.3	5186	7033	1782	98.5	108.6
Western Hemlock	8x16	31	17.5	4828	7109	1805	99.6	110.0
Loblolly Pine	8x16 6x16 6x10 8x8	21	6.5	3706	6259	1521	87.7	92.7
Western Larch	8x16 8x12	36	23.0	3904	6534	1561	91.5	95.1
Redwood	8x16 6x12 7x9	12	18.1	3747	4573	946	64.1	57.6
Tama-rack	6x12	4	16.6	3643	5865	1385	82.3	84.4
Norway Pine	6x12	4	7.8	2928	5255	1103	73.7	67.2

GRADING OF LUMBER

953. Three distinct rules for grading are in force in Western Canada, Mills on the Pacific Coast have their own "Coast Rules", the last being issued on the 1st of December, 1917.

The mills in the mountain district of B. C. use what are known as Mountain Grades, except in connection with Pine Uppers, when the Mississippi Valley Rules are used.

The Spruce Mills of Alberta generally use Mountain Grading Rules, the mills of Saskatchewan and Manitoba, the Mississippi Valley Grading Rules.

The proper grading of lumber is one of the most important essentials in the lumber business. Few retail lumbermen realize the efforts that are made in modern lumbering manufacturing plants in the establishment of proper and uniform grades and the great amount of educational work entailed in endeavoring to procure these results.

The product of every saw log can be used to some purpose if care is exercised in the manufacturing of same, and providing the retail lumberman or salesman introduces it properly to the consumer. In order that the limited timber supply of our country shall be conserved as much

as possible, it is of the greatest importance that this should be borne in mind by the lumber fraternity, and that there should be co-operation between the manufacturer and retail lumberman, with a view to utilizing every portion of the log.

Some grades of lumber can only be used to advantage in certain lengths and sizes, and the logs must therefore be cut accordingly. The grading of lumber, from a manufacturing standpoint, therefore commences in the woods where the logs are cut, and follows through every operation until it is loaded into the car destined to the retail lumberman, who rightfully expects and is entitled to receive just what he has ordered.

The fact that the various lumber manufacturing districts in this country have adopted different grading rules applicable to their particular wood or stock is sometimes confusing to the retail lumbermen, especially when placing orders. For example, there is a vast difference in quality between Manitoba and Saskatchewan grades of spruce shiplap, and British Columbia fir or Cedar shiplap, and this same difference can be noted in numerous other items. Retail lumbermen should understand this as it is often the cause of considerable annoyance due to receiving a grade of lumber not wanted or required by them.

The Mills in Northern Saskatchewan and Manitoba have adopted the Mississippi Valley Association grades as their basis of grading, and in order that their customers receive uniform grades, they have employed an expert inspector, who visits each plant regularly. All complaints on grades are referred to him, and his decision is final.

The following are standard grades and terms by which the Manitoba & Saskatchewan Spruce Lumber Manufacturers' products are known:

SELECT FINISHING

Small pin knots to clear stock.

SELECT COMMON OR TANK STOCK

An extra good quality of selected No. 1. dimensions.

JOISTS, SCANTLING AND TIMBER

No. 1. Grade.

The highest grade of stock for framing purposes—sound in character and admits no defects that will impair the strength of the piece.

No. 2. Grade.

Suitable for cheaper classes of framework and admits of stock containing defects, such as wane, red, dozy streaks, crooked pieces, etc.

No. 3. Grade.

Largely used as elevator cribbing—admits of all imperfections of No. 1. and No. 2. grades, but in much more pronounced form.

COMMON LUMBER

Characteristic of this stock, as compared with Finishing, consists of general coarseness of appearance caused by various defects and combination of defects in a greater or less degree according to grade.

No. 1. Boards and Strips.

This stock suitable for shelving and cheaper classes of finish—includes all sound, tight-knotted stock—free from large coarse knots or any imperfections that will weaken the piece.

No. 2. Boards and Strips.

Suitable for cheapest classes of finish—an excellent shiplap stock. Same general grade as No. 1. except that coarser and larger knots are allowable.

No. 3. Boards and Strips.

An excellent stock for high grade sheathing purposes. May contain combination of defects made up of largo coarse knots, some sound red rot, stain and worm holes.

No. 4. Boards and Strips.

A cheaper grade of sheathing lumber containing defects allowable in No. 3. but in more pronounced form.

The products of above grades, such as shiplap. flooring, drop siding, etc. are subject to the same general rules of grading.

4 FEET LATH (Bundled 50 Pieces to Bundle

No. 1.

Clean well selected stock, of sound material, butted not less than 47¾" long—1½" wide and ⅜" thick.

A variation of 10% off grade is allowable

No. 2.

Slightly inferior to No. 1.—allowing pieces of scant width and thickness, and slight defects, such as traces of rot, wane, worm hole, but no combination of these defects such as will impair the usefullness of the piece.

A grade of lath largely used in larger building centres, but entirely suitable for ordinary yard trade. 10% variation in grade allowed.

The following are a

FEW GENERAL RULES IN THE GRADING OF LUMBER WHICH SHOULD BE OBSERVED

Defects in lumber should be distributed in proportion to the size of the piece. Long or wide pieces of the same grade may contain more and greater defects than shorter or narrower pieces.

The purpose for which the piece is to be used should always be considered as a factor in the establishing of its grade.

Lumber worked on one side is graded from the surface side.

Lumber worked on two sides, with the exception of partition, is graded from the better face.

Partition lumber is graded from its poorer face.

Dressed and Matched lumber, except No. 3. grade and poorer, should have a good bearing on back.

Surfaced one side or two sides lumber should have nearly a full face.

Planing mill work is an important factor and should be taken into consideration in all grades of dressed lumber.

This deals with the grading of lumber from the Saskatchewan and Manitoba Mills.

956. Mountain stock is generally known under the following divisions:

FINISH OR CLEAR	No. 1. No. 2.
SIDING, FLOORING, CEILING	No. 1. Clear No. 2. Clear No. 3. or Common
SHELVING.	No. 1. No. 2.
COMMON.	Select Common No. 1. Common No. 2. Common
SHIP LAP	No. 1. No. 2.

Coast stock under the following:

FINISH OR CLEAR	No. 1 and 2. No. 3.
SIDING, FLOORING, CEILING	No. 1 and 2. No. 3. No. 3½ or common
SHELVING	No. 1. No. 2.
COMMON	Select Common No. 1. Common No. 2. Common
SHIP LAP AND BOARDS	No. 1. No. 2.

The following instructions and definitions are generally applicable to all lumber in Canada. (Table of Standard Finished Sizes also attached).

957. STANDARD CLASSIFICATION
GRADING AND DRESSING RULES
FOR
DOUGLAS FIR, SPRUCE, CEDAR AND
WESTERN HEMLOCK
SUPERSEDING ALL PREVIOUS RULES
(Copyright applied for)

Adopted by the
British Columbia Lumber & Shingle Manufacturers, Limited
1ST DECEMBER, 1917.

GENERAL INSTRUCTIONS

1. All lumber is graded with special reference to its suitability for the use intended.

2. Each piece is considered and its grade determined by its general character, including the sum of all its defects.

3. "Yard Lumber," such as Dimension, Common Boards, Finish, etc., is graded from the face side, which is the best side, except that lumber which is dressed one side only is graded from the dressed side.

4. Factory lumber, which is used for the manufacture of Doors, Sash, etc., and must show on both sides, is always graded from the poorer side. The grade is determined by the quality of suitable cuttings obtainable in each piece.

5. Defects in lumber are to be considered in connection with the size of the piece, wide and long pieces will

carry more defects than smaller pieces in the same grade.

6. No arbitrary rules for the inspection of lumber can be maintained with satisfaction. The variations from any given rules are numerous and suggested by practical common sense, so nothing more definite than the general features of different grades should be attempted by rules of inspection.

7. Lumber must he accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or mill work will prohibit an inspection for the adjustment of claims, except with the consent of all parties interested.

8. A shipment of any grade must consist of a fair average of that grade, mixed widths shall contain a fair assortment of each width. Mixed lengths shall contain a fair asortment of each length.

9. Material not conforming to standard sizes shall be governed by special contract.

10. Standard lengths of lumber are multiples of one foot and two feet.

11. Grade of all regular stock shall be determined by the number, character, and position of the defects visable in any piece.

12. All dressed lumber shall be measured and sold at the full size of sawn material used in its manufacture.

13. All lumber one inch or less in thickness shall be counted as one inch thick.

14. Splits and Checks shall be considered as to length and direction.

15. "Equivalent of combined defects" means that all defects are to be counted, whether specified in rules or not, and measured according to their damaging effect.

16. Timbers and Dimensions are graded from the standpoint of strength and endurance and the only defects to be considered are those which impair the strength or endurance of the piece.

DEFECTS.

17. Recognized defects are knots, knot holes, splits, checks, wane, rot, rotten streaks, pin and grub worm holes, dog and picaroon holes, pitch seams or shakes, pitch pockets, chipped, torn and loose-grain, solid pitch, stained heart, sap stain and imperfect manufacture.

KNOTS.

18. Knots shall be classified as pin, small, standard and large as to size, round and spike as to form, and sound, loose or rotten as to quality.

19. **A Pin Knot** is sound and tight, not over ½ inch in diameter.

20. **A Small Knot** is not over ¾ inch in diameter.

21. **A Standard Knot** is not over 1½ inches in diameter.

22. **A Large Knot** is any size over 1½ inches in diameter.

23. **A Round Knot** is oval or circular in form.

24. **A Spike Knot** is one sawn in lengthwise direction.

25. **A Sound and Tight Knot** is as hard as the wood it is in, and is so fixed by growth or position that it will retain its place in the piece.

26. **A Loose Knot** is one not held firmly in place by growth or position.

27. **A Rotten Knot** is one not as hard as the wood it is in.

28. The mean or average diameter of knots shall be considered in applying or construing the rules.

PITCH

29. **Pitch Seams** or shakes are well defined openings in the grain of the wood, paralleling or crossing the annular rings,, containing more or less pitch, either granulated or liquid.

30. **Pitch Pockets** are small openings or blisters between the grain of the wood, containing more or less pitch, and surrounded by sound wood.

31. In determining the seriousness of the pitch pocket as a defect, both its width and length must be considered. The wider the opening the shorter it must be, or vice versa, the narrower the opening the longer it may be and still be admissible in the classification specified.

32. **Pitch Pockets** shall be classified as small, medium and large.

33. **A Small Pitch Pocket** is one whose open width is 3|32 inch or less, by not over 2 inches in length; 1|16 (or less) by 3 inches in length; less than 1|16 inch by 4 inches in length, and such shall be admissable in grades of No. 1 and 2 Clear as hereinafter specified.

34. **A Medium Pitch Pocket** is one whose open width is not over ¼ inch but more than 1|16 inch, by 3 to 4 inches in length; not over 3|32 inch by 5 inches, and not over 1|16 inch by 6 inches in length, and such shall be admissable in No. 3 Clear Grades.

35. **A Large Pitch Pocket** is one whose open width is more than ¼ inch by 3 inches or longer, or over 1|16 inch by 6 inches in length; these shall not be admissable in any grades above Shelving, No. 4 Clear, and No. 1 Common.

36. **A Tight or Closed Pitch Pocket** is one that does not show an opening through the piece.

37. **An Open Pitch Pocket** is one that shows an opening through the piece.

38. **An Open Pitch Pocket** showing ¼ inch or more in width on both sides of the piece shall be considered the equivalent to a small knot hole.

39. **An Open Pitch Pocket** whose width exceeds 3|32 inch and 4 inches or longer on face side of piece of finishing lumber, shall not be admissable in any grade above No. 3½ Clear.

40. **A Pitch Streak** is a portion of the piece thoroughly saturated with pitch.

41. **Pitch Streaks** shall be classified as small, medium and standard.

42. **A Small Pitch Streak** shall be equivalent to not over ⅛ inch in width and 6 inches in length, and shall be admissable in No. 2 Clear as hereintofore provided.

43. **A Medium Pitch Streak** shall be equivalent to not over ¼ inch in width and 12 inches in length, and shall be admissable in all grades below No. 1 and 2 Clear.

44. **A Standard Pitch Streak** shall he equivalent to one-sixth of the width and one-third of the length of the piece.

SAP

45. **Sap** is bright or stained.

46. **Bright Sap** is that which retains its natural color, and shall not he considered a defect except as provided in the following rules.

47. **Stained Sap** is that which has been discolored and shall be permitted only when specifically mentioned.

HEART STAIN

48. **Heart Stain** is discoloration of heart wood or stained heart, and must not be confounded with rot or rotten streaks.

ROT

49. **Rot** is decay indicated by a decided softness of the wood or by small white spots resembling pin worm holes.

MISCELLANEOUS DEFECTS

50. **Wane** is bark or lack of wood on edges of lumber from any cause. In all grades of Flooring, Ceiling, Drop Siding, etc., wane on the reverse side not exceeding one-third the width and one-sixth the length of any piece is admissable, provided the wane does not extend into the tongue, or on pieces of Flooring and Ceiling into the groove.

51. **Chipped Grain** consists in part of the surface being broken out in small particles below the line of the cut, and as usually found should not be classed as torn grain, and shall be considered a defect only when it unfits the piece for use intended.

52. **Torn Grain** consists in a part of the wood being torn out in dressing. It occurs around knots and on curly grain, and is of four distinct characters—slight, medium, heavy and deep.

53. **Slight Torn Grain** should not exceed 1|32 of an inch in depth, medium 1|16 of an inch, and heavy 1|8 of an inch. Any torn grain more than 1|8 of an inch shall be termed deep.

54. **Loosened Grain** consists of one grain being torn from the next grain and shall be classified as slight, wire edge and injurious.

Pieces having slightly loosened grain or wire edges shall be graded as No. 3 Clear. Injurious loose grain shall not be permitted in any grade above No. 3 Clear.

55. Defects in rough stock caused by improper manufacture and drying will reduce the grades, unless they may be removed by dressing such stock to standard sizes.

56. Imperfect manufacture in dressed stock, such as skips in dressing, torn grain, broken knots, mismatching, insufficient tongue or groove in Flooring, Ceiling, Drop Siding, etc., shall be considered defects and will reduce the grade accordingly as they are slight or serious in their effect on the use of the stock. Flooring, Partition or Drop Siding having less than 3|16 inch of tongue, and Ceiling with less than 1|8 inch of tongue, will not be admitted in any grade above No. 3 Clears.

No. 3 Clears shall not have less than 3|32 inch tongue.

In the absence of a special agreement between the buyer and seller for each order, all dressed lumber is finished to the sizes named in these rules.

STANDARD FINISHED SIZES.

57. **FLOORING—**

Sawn Size	Finished Size	Lengths	Multiples of	Shorts
1 x 3	25/32x 2¼	8 to 18′	1 Ft.	4 to 7′
1 x 4	25/32x 3¼	"	"	"
1 x 6	25/32x 5¼	"	"	"
1¼x 3	1 x 2¼	"	"	"
1¼x 4	1 x 3¼	"	"	"
1¼x 6	1 x 5¼	"	"	"
1½x 3	1 3/16x 2¼	"	"	"
1½x 4	1 3/16x 3¼	"	"	"
1½x 6	1 3/16x 5¼	"	"	"

58. **CEILING—**

⅝x 3	7/16x 2¼	8 to 18′	1 Ft.	4 to 7′
⅝x 4	7/16x 3¼	"	"	"
⅝x 6	7/16x 5¼	"	"	"
1 x 3	11/16x 2¼	"	"	"
1 x 4	11/16x 3¼	"	"	"
1 x 6	11/16x 5¼	"	"	"
	Cedar Shorts			3 to 7′

59. **PARTITION—**

1 x 3	11/16x 2¼	8 to 18′	1 Ft.	4 to 7′
1 x 4	11/16x 3¼	"	"	"
1 x 6	11/16x 5¼	"	"	"

60. **DROP SIDING—**

11/16x 6	⅝x 5¼	8 to 18′	2 Ft.	4 to 6′
1 x 4	¾x 3¼	"	1	4 to 7′
1 x 6	¾x 5¼	"	2	4 to 6′
1 x 8	¾x 7	"	"	"

61. **BEVEL SIDING—**

½x 4	½x 3½	8 to 18′	6 In.	3 to 7′
½x 5	½x 4½	"	"	"
½x 6	½x 5½	"	"	"

62. **RUSTICS—**

T. & G Angle

1 x 4	¾x 3¼	8 to 20′	1 Ft.	4 to 7′
Angle				
1 x 4	¾x 3¼	"	"	"
1 x 6	¾x 4⅞	"	"	"

63. **BULL NOSE OR NOVELTY—**

1 x 6 finished same as Angle.

64. **"V" AND CHANNEL—**

1 x 6	¾x 4⅞	8 to 20′	1 Ft.	4 to 7′
1 x 8	¾x 6¾	"	"	"

65. **FINISH AND SHELVING (S4S)—**

Sawn Size	Finished Size	Lengths	Multiples of Shorts
			1 Ft.
1 x 3	¾x 2½	6 to 18′	"
1 x 4	¾x 3½	"	"
1 x 5	¾x 4¼	"	"
1 x 6	¾x 5¼	"	"
1 x 8	¾x 7¼	"	"
1 x10	¾x 9¼	"	"
1 x12	¾x11	"	"
1 x14	¾x13	"	"
1¼x 3	1 x 2½	"	"
1¼x 4	1 x 3½	"	"
1¼x 5	1 x 4¼	"	"
1¼x 6	1 x 5¼	"	"
1¼x 8	1 x 7¼	"	"
1¼x10	1 x 9¼	"	"
1¼x12	1 x11	"	"
1¼x14	1 x13	"	"
1½x 3	1 3/16x 2½	"	"
1½x 4	1 3/16x 3½	"	"
1½x 5	1 3/16x 4¼	"	"
1½x 6	1 3/16x 5¼	"	"
1½x 8	1 3/16x 7¼	"	"
1½x10	1 3/16x 9¼	"	"
1½x12	1 3/16x11	"	"
1½x14	1 3/16x13	"	"
2 x 3	1⅝x 2½	"	"
2 x 4	1⅝x 3½	"	"
2 x 5	1⅝x 4¼	"	"
1¾x 6	1 x 5¼	"	"
2 x 8	1⅝x 7¼	"	"
2 x10	1⅝x 9¼	"	"
2 x12	1⅝x11	"	"
2 x14	1⅝x13	"	"

66. **STEPPING—**

Sawn Size	Finished Size	Lengths	Multiples of	
				1 Ft.
1¼x10	1 x 9¼	6 to 18′		"
1¼x12	1 x11	"	[10% 3′	"
1½x10	1¼x 9¼	"	3½′ & 4′	"
1½x12	1¼x11	"	{ lengths	"
2 x10	1⅝x 9¼	"	may be	"
2 x12	1⅝x11	"	[shipped	"

67. **CASING—**

1 x 5	¾x 4¼	8 to 18′	1 Ft.	4 to 7′
1 x 6	¾x 5¼	"	"	"

68. **BASE—**

1 x 8	¾x 7¼	6 to 18′	1 Ft.
1 x10	¾x 9¼	"	"
1 x12	¾x11	"	"

69. **WINDOW JAMB—**

1 x 6	¾x 5¼	8 to 18′	1 Ft.	4 to 7′
1¼x 6	1 x 5¼	"	"	"

70. **DOOR JAMB—**

1½x 6	1¼x5¼	3, 7, 10, 14, 15, 16, 17, 18 Ft. Lgths.
2 x 6	1⅝x5¼	3, 7, 10, 14, 15, 16, 17, 18 Ft. Lgths.

STANDARD FINISHED SIZES

71. **COMMON BOARDS S1S—**

Shall be ¾ inch thick; lengths, 8 to 16 feet; in multiples of 2 feet.

72. **SHIPLAP—**

Sawn Size	Finished Size	Lengths	Multiples of
1 x 6	¾x 5¼	8 to 16′	2 Ft.
1 x 8	¾x 7¼	"	"
1 x10	¾x 9¼	"	"
1 x12	¾x11¼	"	"

73. **COMMON DIMENSION—**

(S1S and Sized or Jointed on Edge by either Saw or Planer or S4S.)

2 x 2	1⅝x 1⅝	2 Ft.
2 x 3	1⅝x 2⅝	"
2 x 4	1⅝x 3⅝	"
2 x 6	1⅝x 5⅝	"
2 x 8	1⅝x 7½	"
2 x10	1⅝x 9½	"
2 x12	1⅝x11½	"
2x 14	1⅝x13	"
2 x16	1⅝x15	"
3 x 3	2½x 2½	"
3 x 4	2½x 3½	"
3 x 6	2½x 5½	"
3 x 8	2½x 7½	"
3 x10	2½x 9½	"
3 x12	2½x11½	"
3 x14	2½x13	"
3 x16	2½x15	"

74. **TIMBER—**

(S1S1E or S4S) 4x4 and larger, ½ inch off thickness and width.